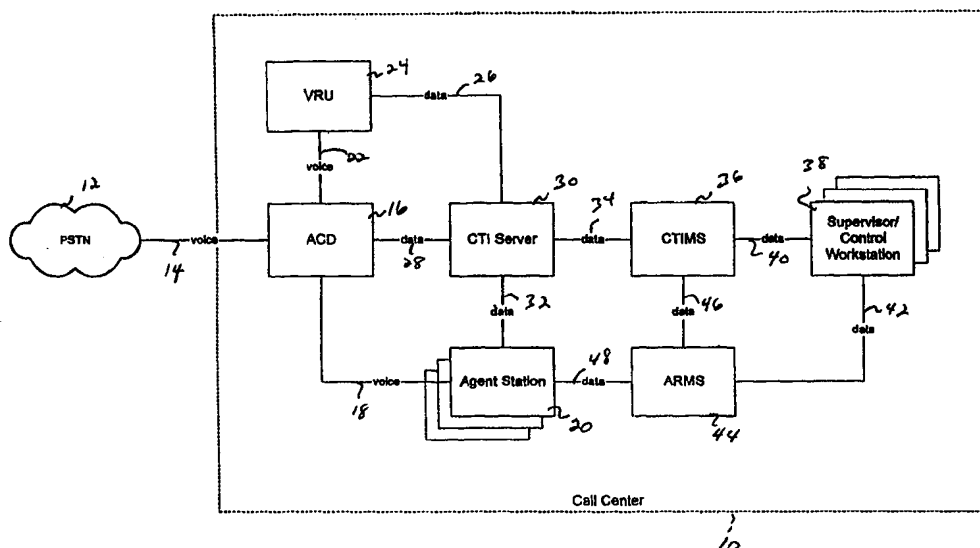




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**(54) Title:** COMPUTER/TELEPHONY INTEGRATION MONITORING SERVER FOR A CALL CENTER

**(57) Abstract**

A monitoring system monitors calling activity within a call center. The monitoring system includes a computer/telephony integration monitoring server (CTIMS). CTIMS gathers statistics regarding calling activity within the call center and maintains state information regarding agents in the call center. CTIMS may maintain statistics regarding agents, supervisors, business clients, and call centers. These statistics may be passed to a client application program that displays the statistics to a supervisor or other party.

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## COMPUTER/TELEPHONY INTEGRATION MONITORING SERVER FOR A CALL CENTER

## TECHNICAL FIELD

The present invention relates generally to telecommunications systems and more particularly to a computer/telephony integration monitoring server for a call center.

## BACKGROUND OF THE INVENTION

A typical call center includes a number of agents who field inbound telephone calls and place outbound telephone calls. Each agent has an associated station that includes a personal computer or workstation, a phone pad and a head set. The agent may place outbound sales calls to potential customers or field inbound calls (such as 800 number calls) from potential customers. The agents are organized into groups and have associated supervisors, who are responsible for managing and overseeing the agents. Each agent may receive or place calls for different business clients.

One of the difficulties encountered in such a call center is the difficulty of monitoring the phone activity of the agents. It is difficult for a supervisor to obtain useful information about the activities of agents in a timely fashion. Such a lack of information makes it difficult for a supervisor to properly manage the agents and increase the profitability of the call center. In general, a supervisor must perform manual analysis and calculation to obtain useful data regarding agent performance.

## SUMMARY OF THE INVENTION

The present invention addresses the limitations of the prior art by providing a computerized monitoring system for monitoring activities of agents within a call center. The monitoring system may gather status information and statistics regarding agent activities. The gathered status information and statistics

may be displayed as part of a graphical user interface that is provided by an application program.

In accordance with a first aspect of the present invention, a method is practiced in a call center that has agents who handle calls. In accordance with  
5 this method, a monitor is provided for monitoring calling activity by the agents and for gathering statistics regarding the calling activity of the agents that summarize calling activity per business client. The monitor is used to gather statistics regarding the calling activity of the agents and the statistics are passed to an application program. The monitor may also monitor the state of the agents  
10 in the call center and maintain state information regarding the agents. Such state information may be passed to an application program.

In accordance with a further aspect of the present invention a computer system monitors calling activity by agents in a call center. The call center has a computer/telephony integration (CTI) server for generating events  
15 about calling activity in the call center and an application program. The computer system includes an interface for receiving events generated by the computer/telephony integration server. The computer system also includes a statistics generating process for generating statistics regarding calling activity by agents in the call center. The computer system additionally includes an interface  
20 to the application program for passing statistics generated by the statistics generating process to the application program.

In accordance with another aspect of the present invention, a statistics server is provided for generating statistics regarding calling activity of the agents. An event source is provided for generating events regarding calling  
25 activity of the agents within the calling center. An event is generated by the event source and a report of the event is forwarded to the statistics server. The statistics server generates statistics regarding calling activity of the agents. The generated statistics are forwarded from the statistics server to an application program. The statistics are displayed on the display device by the application  
30 program.

## BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention will be described below relative to the following drawings.

Figure 1 is a block diagram of a portion of a telecommunications system that is suitable for practicing the preferred embodiment of the present invention.

Figure 2 is a block diagram that depicts the data flow between the computer/telephony integration (CTI) server 30, the CTI monitoring server (CTIMS) and a client application program.

Figure 3 depicts an object architecture that is suitable for practicing the preferred embodiment of the present invention.

Figure 4 depicts the modules found in CTIMS.

Figure 5 is a flowchart illustrating the steps that are performed by CTIMS when it becomes active.

Figure 6 is a flowchart illustrating the steps that are performed to process events received from the CTI server at CTIMS.

Figure 7 lists event types for event messages that are output by the CTI server.

Figures 8A and 8B list attributes of agent objects used in the preferred embodiment of the present invention.

Figure 9 lists attributes of a center object that are used in the preferred embodiment of the present invention.

Figure 10 lists attributes of a business object that are used by the preferred embodiment of the present invention.

Figure 11A is a flowchart illustrating the steps that are performed to send state changes to a client application program from CTIMS.

Figure 11B is a flowchart that illustrates the steps that are performed to provide statistics to a client application program from CTIMS.

## DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiment of the present invention provides a monitoring system for a call center. The preferred embodiment relates particularly to a computer/telephony integration monitoring server (CTIMS) that  
5 gathers statistics regarding agent calling activities and maintains state information regarding agents. The statistics are passed to a client application program that displays information regarding agent activities on an intuitive user interface. The statistics provided by CTIMS may include statistics classified by call center, by agent, by supervisor or by business client. Statistical information  
10 may also be provided that is categorized by call type. For example, statistical information may be provided that specifies the number of outbound calls, the number of internal calls (*i.e.*, within the call center) and the number of inbound calls handled within the call center. The statistics may be displayed in a graphical format or as part of a graphical user interface by the client application  
15 program.

The CTIMS provides an automated way to gather useful statistics for a supervisor or other manager within the call center. CTIMS performs classification of statistical data to provide reports in formats that are useful to a supervisor. As CTIMS is completely automated, there is no need for a supervisor  
20 to manually classify or manipulate data to obtain useful information.

Figure 1 is a block diagram that illustrates a portion of a telecommunications network that is suitable for practicing the preferred embodiment of the present invention. The telecommunications network includes a call center 10 that is connected to a public switched telephone network (PSTN)  
25 12 via a voice trunk 14. Those skilled in the art will appreciate that the call center 10 may also be alternatively connected to other types of networks from which calls may originate. The call center 10 includes an automatic call distributor (ACD) 16 or other switching mechanism for distributing incoming calls within the call center. The ACD 16 is connected via voice trunk 18 to agent  
30 stations 20. These agent stations 20 include a workstation or personal computer,

a phone pad and a head set. Agents are stationed at the stations 20 and utilize the resources contained therein to process calls. The ACD 16 is also connected via a voice trunk 22 to a voice response unit (VRU) 24. The VRU 24 automates call processing. The VRU 24 may be used to collect information such as account  
5 numbers, credit card numbers and service requests from callers. The VRU 24 is connected to a computer/telephone integration (CTI) server 30 via a data link 26. The CTI server 30 extracts call data from the ACD 16. In particular, the CTI server 30 abstracts raw call data from the ACD 16 into useful statistical data. The CTI server 30 also distributes data in the form of events. The CTI server 30  
10 may run as a separate process on a dedicated computer system. A suitable CTI server is the T Server produced by Genesys Labs of San Bruno, California. The CTI server 30 is connected to the ACD 16 via data link 28 and is also connected to the agent stations 20 via a data link 32.

CTI monitoring server (CTIMS) 36 is connected to the CTI server  
15 30 via data link 34. CTIMS 36 may be implemented on a dedicated computer or on a shared computer that also runs the CTI server 30 process. CTIMS 36 compiles statistical data that is collected from the CTI server 30 into useful data for presentation and management at the supervisor/control workstations 38. This data is utilized by the client application program of the preferred embodiment of  
20 the present invention, as will be described in more detail below. CTIMS 36 registers with the CTI server 30 to receive events for each logical workstation number. Examples of events that are output by the CTI server 30 include events indicating calls received, calls routed, calls answered, and calls disconnected. These events will be discussed in more detail below. CTIMS 36 categorizes the  
25 events into groups, such as by agent, by supervisors, by call center, by business type and the like. CTIMS 36 also calculates certain statistics, such as average call handling times.

CTIMS 36 is connected to an automated resource management system (ARMS) 44 via data link 46. ARMS 44 provides management of  
30 resource data for the call center. ARMS 44 is largely a database on a server that

contains interfaces for access by CTIMS 36 and supervisor/control workstations 38.

It should be appreciated that data links 26, 32, 34, 40, 42, and 48 may all be implemented as local area network (LAN) connections. A suitable LAN is an Ethernet LAN.

Those skilled in the art will appreciate that the call center 10 may have a different configuration other than that depicted in Figure 1.

Initially, a call originates from the PSTN 12 and is sent over voice trunk 14 to the ACD 16. The ACD 16 decides where the call should be sent. The call is initially routed over voice trunk 22 to the VRU 24. The VRU 24 includes voice messages for obtaining information from the caller. As was mentioned above, the VRU 24 may collect information such as account numbers, credit card numbers and service requests. The gathered information is passed over data link 26 to the CTI server 30. The CTI server 30, in turn, passes the data to the agent workstation 20 that will be servicing the call. The ACD 16 then switches the call to the agent station 20 that is to handle the call. An application may be run on the agent workstation to provide a screen pop with the information that has been collected by the VRU 24 so that the agent at the agent station 20 has the collected information available. The agent accepts the call and processes it accordingly. Additional information about the caller may be retrieved from ARMS 44.

As was mentioned above, the ACD 16 outputs information regarding the routing and processing calls over data link 28 to the CTI server 30. The CTI server 30 outputs events that are packaged in event structures that are forwarded to CTIMS 36 over the data link 34. These events are processed and categorized by CTIMS 36 and sent over data link 40 to a client application program at the supervisor/control workstations 38. The client application program uses the information from CTIMS 36 to generate a GUI to help a supervisor monitor activity within the call center.



Figure 2 depicts the data flow between the CTI server 30, CTIMS 36 and the client application program 51 that is run on the supervisor/control workstation 38. The CTI server 30 outputs event structures 50 that encapsulate information about events to parties that have registered to receive the events.

5 CTIMS 36 registers to receive such events. It should be appreciated that multiple instances of the client application program may be concurrently running on separate supervisor/control workstations and that the events output by the CTI server 30 are output to each of the instances. CTIMS 36 processes the event structure 50 to extract relevant information and update state statistics maintained

10 therein. Two types of information are communicated between CTIMS 36 and a client application program 51. Each of these types of information has an associated socket (such as found in the UNIX operating system). The first type of information is state change information that indicates a change in the state of an agent. An agent may generally be in one of the following states: unavailable,

15 available, on call, call work, error or unknown. When the agent is in an unavailable state, the agent is not available for processing calls. When the agent is in an available state, the agent is not currently processing a call and is available to process new calls. When the agent is in an on call state, the agent is handling a call. When the agent is in an error state, an error has occurred. An agent may

20 also be in an unknown state when the monitoring system is not aware of the agent's current status. An agent may be in the call work state, which indicates that the agent is done with the call and is working on the call data. Calls may be of different call types: an outbound call, a conference call, an internal call, an unknown call, or an inbound call. When an agent changes state, CTIMS 36

25 sends a state change event 52 (which may be viewed as an event report) to the client application program 51 that identifies the change in state. For example, if an agent changes from being available to unavailable, CTIMS 36 generates an event that is sent to the client application program 51.

CTIMS 36 also provides a second type of information: statistics

30 56. The statistics 56 are used by the client application program 51 and are

displayed as part of the GUI produced by the client application program. The GUI is described in more detail in copending application entitled "Monitoring System Client for a Call Center," which was filed on even date herewith, which is assigned to a common assignee and which is explicitly incorporated by reference herein. For purposes of efficiency, the statistical information is not continuously fed into the client application program 51; rather, the client application program 51 polls CTIMS 36 on a periodic basis (such as every 5 seconds) by sending requests 54 to receive updated statistics 56 from CTIMS. The client program 51 may request agent statistics regarding agents, supervisor statistics regarding supervisors, business statistics regarding business clients, center statistics regarding the entire call center, and state statistics regarding agent states.

The monitoring system of the preferred embodiment of the present invention adopts an object-oriented architecture. Figure 3 illustrates a number of the object classes that are utilized within this architecture in a Booch diagram. Business objects are provided for each business client of the call center. Business clients pay for agents of the call center to handle calls on their behalf. The business objects are of the business object class 74. Agent objects are created for each agent within the call center. The agent objects are of the agent object class 76 and hold information regarding specific agents in the call center. Information regarding supervisors of agents is stored in the objects of the supervisor object class 78. A group object class 80 is provided and serves an abstract base class from which other classes can be derived to maintain statistical information pertaining to a predefined group of agents. Each group has an associated instance of the group object class associated with it. Each call center may have a separate center object of the center object class 82. Each center object holds information regarding the associated call center.

The CTIMonitor object class 80 is for objects that are responsible for receiving and broadcasting information from and to the CTI server 30. This information may include agent user IDs and passwords, directory numbers

assigned agents and phone pads used by agents. The config object class 88 is for objects that hold objects that maintain configuration information. Each socket has an associated instance of the IS ("intelligent service") object class 89. These sockets are used to communicate with instances of the monitoring system client  
5 that are of the UA ("user agent") object class 91.

Figure 4 shows a logical organization of CTIMS 36. Specifically, CTIMS is divisible into a number of different types of modules. Each module may include multiple objects. The main module 90 is responsible for controlling operations of CTIMS 36. IS module 92 handles socket communications. The  
10 events module 94 handles the processing of events received from the CTI server 30. The business module 96 calculates business statistics based upon stored information and events received from the CTI server 30. The database (db) module 98 is responsible for interfacing with the database to get data as needed. The database, as used in this context, refers to that database stored within the  
15 ARMS 44. The config module 99 is responsive for performing configuration of CTIMS. The agent module 100 gathers and calculates statistics for agents. The center module 102 gathers and calculates statistics for call centers. The entity module 104 is responsible for resetting the statistics. This module may reset the statistics on a daily basis so that the statistics are current only for the given day.  
20 The supervisor module 106 gathers and calculates supervisor statistics.

In the preferred embodiment of the present invention, CTIMS 36 is run as a multithreaded process. The main process communicates with the CTI server 30 and the database in the ARMS 44. At least one thread is provided to communicate with the client application programs 51. Separate threads process  
25 client requests. Specifically, a separate thread is allocated for each client application program request. Another thread is allocated to perform the resetting that is done by the entity module 104.

Figure 5 is a flowchart illustrating the steps performed by CTIMS 36 when CTIMS initially becomes active. First, CTIMS 36 reads a configuration  
30 file (of the config object class 88) (see Figure 3) (step 110 in Figure 5). The

configuration file is read to obtain various settings that are used by CTIMS 36. This configuration data may include hierarchy data that defines groupings. For example, the section [socket] may have a read port ID and a write port ID. CTIMS 36 retrieves data from the database in ARMS 44 (step 112 in Figure 5).  
5 This may include agent phone numbers, logical workstation numbers (lwns), and the like. This information, along with the events from the CTI server 30, helps CTIMS 36 to build the relationships of agents to pad numbers and workstation numbers, and to identify what agents are servicing given business clients. CTIMS 36 then registers with the CTI server 30 for each lwn (step 114 in  
10 Figure 5). IS module 92 spawns threads as needed (step 116 in Figure 5). CTIMS 36 begins processing events received from the CTI server 30 and handling requests from the supervisor/control workstations 38 (step 118 in Figure 5).

Once CTIMS 36 begins processing events, it largely operates in a  
15 loop-like fashion. Figure 6 is a flowchart showing the steps that are performed for processing events received from the CTI server 30. CTIMS 36 looks to determine whether there is an event on the socket that is used for communications between the CTI server 30 and CTIMS (step 120 in Figure 6). If there is an event on the socket, the event is processed (step 122 in Figure 6).  
20 This is repeated until CTIMS 36 is done processing events (see step 124 in Figure 6). It should be appreciated that the CTI server 30 and CTIMS 36 agree on dispatch functions that are to be used to dispatch TEvent structures (which hold event information). Specifically, a callback function is specified and used to dispatch messages when they are on the socket.

25 In order to get an appreciation for how the events are processed (see step 122 in Figure 6), it is helpful to review the different types of events that are sent from the CTI server 30. Figure 7 itemizes a number of the different event types that are relevant to the preferred embodiment of the present invention. The EventAgentLogin event type 128 reports that an agent has just  
30 logged onto an agent station 20. Conversely, the EventAgentLogout event type

130 indicates that an agent has logged out. These event types 128 and 130 are used by CTIMS to track agent login/logout times and duration of being logged in. The EventAgentReady event type 132 indicates that an agent has made the agent station ready for operation. The EventAgentNotReady event type 134 indicates  
5 that the agent is not ready for operation. The EventAgentBusy event type 136 indicates that the telephone set of the agent is done with a call and still working on some customer data and the EventAgentNotBusy event type 138 indicates that the agent's telephone set is not currently busy.

The EventCallAbandonedQueue event type 140 indicates that there  
10 was no available agent to handle a call that was in the queue and, as a result, the caller opted to disconnect the call rather than waiting in the queue. This event type may be used by CTIMS in calculating abandoned calls. The EventCallEnteredQueue event type 142 indicates that a call has entered the queue but has not yet been reached by an agent. The EventCallForwardCancel event  
15 type 144 indicates that call forwarding for a given phone number has been canceled. The EventCallForwardSet event type 146 indicates that calls to a particular telephone set are being forwarded. The EventUserEvent event type 148 indicates that a user event has occurred.

The EventConferenced event type 152 indicates that a call has been  
20 conferenced in with other calls at other locations. The EventDestinationBusy event type 154 indicates that the destination of a call is currently busy. The EventDialing event type 156 indicates that a call is being dialed. The EventAddressFreed event type 157 indicates that the allocated memory of an address is freed. The EventAttachedDataChanged event type 158 indicates that  
25 attached data to a call has changed. The EventError event type 160 indicates that an error has occurred. This event type is used in calculating error status information and agent state information. The EventEstablished event type 162 indicates that a call has been connected successfully. This message type indicates that a call has successfully reached an agent.

The EventOffHook event type 164 indicates that a telephone receiver is off the hook. The EventOnHook event type 166 indicates that a telephone receiver is on hook. The EventReleased event type 168 indicates that a call has been disconnected. This event type indicates the end of a call with an agent. The EventRetrieved event type 170 indicates that a call has been transferred or a conference has been retrieved. The EventRinging event type 172 indicates the arrival of a call on the ACD 16. The EventAddressAllocated event type 174 indicates that memory for a given address has been allocated. The EventRouteRequest event type 176 indicates a call was made using a special number, has reached an agent and is waiting to be routed. The EventServerDisconnected event type 178 indicates that a connection to a local server has been lost and the EventTransferred event type 180 indicates that a call is being transferred to another location.

The EventMailBoxLogin event type 181 indicates that a user has logged into a mailbox. Conversely, the EventMailBoxLogout event type 183 indicates that a user has logged out of a mailbox. The EventVoiceFileOpened event type 185 indicates that a user has opened a voice file in the user's mailbox, and the EventVoiceFileClosed event type 187 indicates that a user has closed a voice file in the user's mailbox.

The event types itemized in Figure 7 are utilized to gather information regarding agent status and to develop statistics on CTIMS 36. The TEvent structure also holds additional information that is used by CTIMS 36. This additional information includes an agent ID that specifies the ACD ID for the call. This ACD ID refers to a telephone pad ID, which in turn may be associated with an agent. The TEvent structure may also include an ANI attribute that holds a pointer to Automatic Number Identification Service digits for the current call. Information regarding call type (such as inbound call, outbound call, internal call, consult call, or unknown call) may be provided within the TEvent structure. A DNIS attribute may be included in the TEvent structure that includes a pointer to an ASCII representation of the Dialed Number

Identification Service digits for the current call. These DNIS values are associated with business clients so that CTIMS 36 knows the business client for which the call is being handled. The TEvent structure may also hold error code information and error message information.

5                   As was mentioned above, CTIMS 36 maintains information about each agent in a respective agent object. The agent objects include attributes or data members and member functions for manipulating the data stored therein. Figures 8A and 8B list a number of the attributes 182 found within an agent object. Attribute 190 identifies the agent associated with the object. Attribute  
10   192 holds an identifier of the supervisor of the agent. Attribute 200 holds state information regarding the agent. The agent state information in attribute 200 is used internally by CTIMS 36. The monitoring system state 202 specifies a state of the agent as utilized by the client application program. This state may be one of the following states: Logout, Unknown, Error, Available, Unavailable,  
15   Call\_Work, Inbound\_Call, Outbound\_Call, Internal\_Call, Consult\_Call, or Unknown\_Call.

                  Attribute 204 holds an array of counts and specifies the number of inbound calls per business client. Attribute 206 holds a call count specifying the number of calls processed by the agent. Attribute 208 holds an array of total  
20   number of calls as indexed by call type. Attribute 210 holds an indication of the call type currently being processed, and attribute 212 holds a business client code that identifies the business client for which a call is currently being processed. The OnCall attribute 214 holds a value that specifies flag. The Pad attribute 216 holds a string of characters that identify the telephone pad the agent is utilizing.

25                   Attribute 218 holds the login time for the agent, and attribute 220 holds the logout time for the agent. Attribute 222 specifies the time at which the last state change occurred. Attribute 224 holds the time at which a call was established with the agent and attribute 226 holds the time at which a call was released by the agent. Attribute 228 specifies the time at which the agent entered

a ready state. Attribute 230 holds a time at which the agent entered an available state. Attribute 232 holds a time at which the agent entered an unavailable state.

Attribute 234 specifies the time during which an agent was on a call. Attribute 236 specifies the time during a call in which the agent was  
5 working (*i.e.*, not talking). Attribute 238 holds a time during which an agent was in an error state. Attribute 240 holds a time during which the agent was in an unknown state. Attribute 242 holds the current time and attribute 244 holds a reference time value. Attribute 246 holds a time at which the time settings are to be reset. Attribute 248 holds a string regarding the time at which a state change  
10 occurred.

Attribute 250 holds a value in seconds of total login time for the agent. Attribute 252 holds a value that specifies the total time in seconds during which the agent has been in the available state. Attribute 254 holds a value equal to the total time in seconds in which the agent has been in an unavailable state.  
15 Attribute 256 holds a value in seconds that specifies the total time in which the agent has been on call. Attribute 258 holds an array wherein each entry holds a total value in seconds in which the agent has been on an inbound call for a given business client. Attribute 260 holds a value in seconds equal to the total time in which the agent has been on an outbound call. Attribute 262 holds a value in  
20 seconds equal to the total time in which the agent has been on an internal call. Attribute 264 (see Figure 8B) holds the total time in seconds in which the agent has been on a consulting call. Attribute 266 holds a value in seconds equal to the total time in which the agent has been on an unknown call.

Attribute 268 holds a value equal to the total time in seconds in  
25 which the agent has been working on a call. Attribute 270 holds a value equal to the total time in seconds in which the agent has been in an error state. Attribute 272 holds a value equal to the total time in seconds in which the agent has been in an unknown state. Attribute 274 holds a value equal to the talk time of a current call. Attribute 276 holds an array that specifies the total talk time by the  
30 agent for calls indexed by business client. Attribute 278 holds an array of values



that specify the average talking time indexed by call type. Attribute 280 holds the average talk time by the agent for all calls processed by the agent. Attribute 282 holds the average working time for all calls processed by an agent, and attribute 284 holds the average handling time for all calls handled by an agent.

5           Attribute 286 holds a value equal to the number of ghost calls received by the agent. Attribute 288 holds a value equal to the number of hang-ups on the agent. Attribute 290 holds a value equal to the total number of calls handled by the agent. Attribute 292 holds an array of entries indexed by business client that specify the number of inbound calls handled by the agent for the  
10           associated business client. Attribute 294 holds a value equal to the total number of outbound calls handled by the agent, and attribute 296 holds a value equal to the total number of internal calls handled by the agent. Attribute 298 holds a value equal to the number of consulting calls handled by the agent and attribute 300 holds a value equal to the number of unknown calls handled by the agent.  
15           Attribute 302 holds information regarding skills possessed by an agent and attribute 304 holds a NewAgent attribute.

Each agent object also includes member functions for obtaining and maintaining the attributes discussed above.

In order to gain appreciation for the information and statistics that  
20           are maintained by CTIMS 36 for a call center 10, it is helpful to review attributes 305 of a center object. Figure 9 depicts such attributes. Attribute 306 holds an ID that identifies the call center associated with the object. Attribute 310 holds a value that specifies the number of abandoned calls that occurred since the last reset. Attribute 312 holds a value that identifies the number of ghost calls for the  
25           call center since the last reset. Attribute 314 holds a value specifying the number of hang-ups since the last reset. Attribute 316 holds a value that specifies the number of calls that have been handled by the call center since the last reset, and attribute 318 holds a total call count for the call center since the last reset.

Attribute 320 specifies the percentage of agents that are available  
30           and attribute 322 holds a value that specifies the percentage of agents that are

unavailable. Attribute 324 specifies a percentage of agents that are currently working on calls. Attribute 326 holds a value specifying the number of inbound calls received by the call center and attribute 328 specifies the total calls for the call center. Attribute 330 specifies business data.

5                   Attribute 332 specifies the total time in hours in which agents have been available and attribute 334 specifies the total time in hours in which agents have been unavailable. Attribute 336 specifies in hours the total time in which agents have been working on calls and attribute 338 specifies the total time in hours in which agents have been logged in. Attribute 340 holds a value that  
10 indicates the number of calls that have been handled. Attribute 342 holds a value that specifies the number of outbound calls that have been handled. Attribute 344 holds a value that specifies the number of internal calls that have been handled. Attribute 346 holds a value that indicates the number of consulting calls that have been handled and attribute 348 specifies the number of unknown calls  
15 that have been handled. Lastly, attribute 350 holds the current time.

CTIMS 36 also maintains business statistics and stores much of this information within business objects that are created for respective business clients. Figure 10 depicts the attributes 359 of such a business object. Attribute  
20 360 holds an ID that identifies the business client and attribute 362 specifies the number of agents that are currently on calls for the business client. Attribute 364 holds a value that indicates the number of calls that are currently in a queue for the business client and attribute 366 holds a value that identifies the number of calls that have abandoned for the client. The number of ghost calls for the client is held in attribute 368. Attribute 370 holds the number of hang-ups for the  
25 client. Lastly, attribute 372 holds the number of calls that have been handled for the client.

Once CTIMS 36 has calculated the statistics and updated the state information, this information may be obtained by the client application program  
51. Figure 11A is a flowchart illustrating the steps that are performed in sending  
30 state change information to the client application program. Specifically, CTIMS

36 receives an event from the CTI server 30 that indicates that a state change has occurred (step 374 in Figure 11A). CTIMS 36 then updates the state information it maintains internally (step 376 in Figure 11A). A state change event or message is then sent to all of the client application programs (step 380 in Figure 11A).

5                   CTIMS 36 may also send statistics to the client application program 51. As was mentioned above, the client application program 51 polls CTIMS for such statistics. The process begins when the client application program sends a request that is received at CTIMS 36 for statistics (step 382 in Figure 11B). The requested statistics have been gathered by CTIMS from the  
10   objects that it maintains (step 384 in Figure 11B). The statistics are then sent to the client application program (step 386 in Figure 11B).

                  While the present invention has been described with reference to a preferred embodiment thereof, those skilled in the art will appreciate that various changes in form and detail may be made without departing from the intended  
15   scope of the present invention as defined in the appended claims.

## CLAIMS

1. In a call center having agents who handle calls on behalf of business clients, a method practiced in a computer system, comprising the computer-implemented steps of:

providing a monitor for monitoring calling activity by the agents and gathering statistics regarding the calling activity of the agents;

with the monitor, gathering statistics regarding the calling activity of the agents that summarize calling activity per business client; and

passing the statistics to an application program.

2. The method of claim 1 wherein the statistics include agent statistics that summarize agent calling activity per agent.

3. The method of claim 1 wherein the statistics include call center statistics that summarize calling activity for the entire call center.

4. The method of claim 1 wherein the statistics include a number of outbound calls originated by one of the agents.

5. The method of claim 1 wherein the statistics include a number of calls handled by one of the agents for one of the business clients.

6. The method of claim 1 wherein the statistics include an indication of how often one of the agents is handling a call.

7. The method of claim 1 wherein the statistics include an indication of how often an agent is unavailable to handle calls.

8. The method of claim 1 wherein the statistics include an indication of how often an agent is available to handle calls but not handling calls.

9. The method of claim 1 wherein the statistics include a number of calls handled by the call center.

10. In a call center having agents who handle calls, a method practiced in a computer, comprising the computer-implemented steps of:

providing a monitor for monitoring a state of the agents in the call center;

with the monitor maintaining state information regarding the agents;

passing the state information to an application program.

11. The method of claim 1, further comprising the step of providing an indication of for which business client a call is being handled by an agent.

12. In a call center having agents who handle calls on behalf of business clients, a computer-readable medium holding computer-executable instructions for performing a method practiced in a computer system, comprising the computer-implemented steps of:

providing a monitor for monitoring calling activity by the agents and gathering statistics regarding the calling activity of the agents;

with the monitor, gathering statistics regarding the calling activity of the agents that summarize calling activity per business client; and

passing the statistics to an application program.

13. The computer-readable medium of claim 12 wherein the statistics include agent statistics that summarize agent calling activity per agent.

14. The computer-readable medium of claim 12 wherein the statistics include call center statistics that summarize calling activity for the entire call center.

15. The computer-readable medium of claim 12 wherein the method further comprises the step of providing an indication of for which business client a call is being handled by an agent.

16. In a call center having agents who handle calls, a computer-readable medium holding computer-executable instructions for performing a method practiced in a computer, comprising the computer-implemented steps of:

providing a monitor for monitoring a state of the agents in the call center;

with the monitor maintaining state information regarding the agents;

passing the state information to an application program.

17. A computer system for monitoring calling activity by agents in a call center, said call center having a computer telephony integration server for generating events about calling activity in the call center and an application program, comprising:

an interface for receiving events generated by the computer/telephony integration server;

a statistics generating process for generating statistics regarding calling activity by agents in the call center; and

an interface to the application program for passing statistics generated by the statistics generating process to the application program.

18. The computer system of claim 17 wherein the statistics generating process includes an agent module for generating statistics about calling activity of agents on a per agent basis.

19. The computer system of claim 17 wherein the statistics generating process includes a call center module for generating statistics about calling activity of agents on a per call center basis.

20. The computer system of claim 17 wherein the call center services business clients and wherein the statistics generating process includes a business module for generating statistics on a per business client basis.

21. The computer system of claim 17 wherein the agents have supervisors and wherein the statistics generating process includes a supervisor module for generating statistics on a per supervisor basis.

22. In a call center having agents for handling calls, a method comprising the computer-implemented steps of:

- providing a statistics server for generating statistics regarding calling activity of the agents;

- providing an event source for generating events regarding calling activity of agents within the call center;

- generating an event from the event source;

- forwarding a report of the event to the statistics server;

- generating statistics regarding calling activity of the agents at the statistics server;

- forwarding the generating statistics from the statistics server to an application program; and

- displaying the statistics on a display device by the application program.

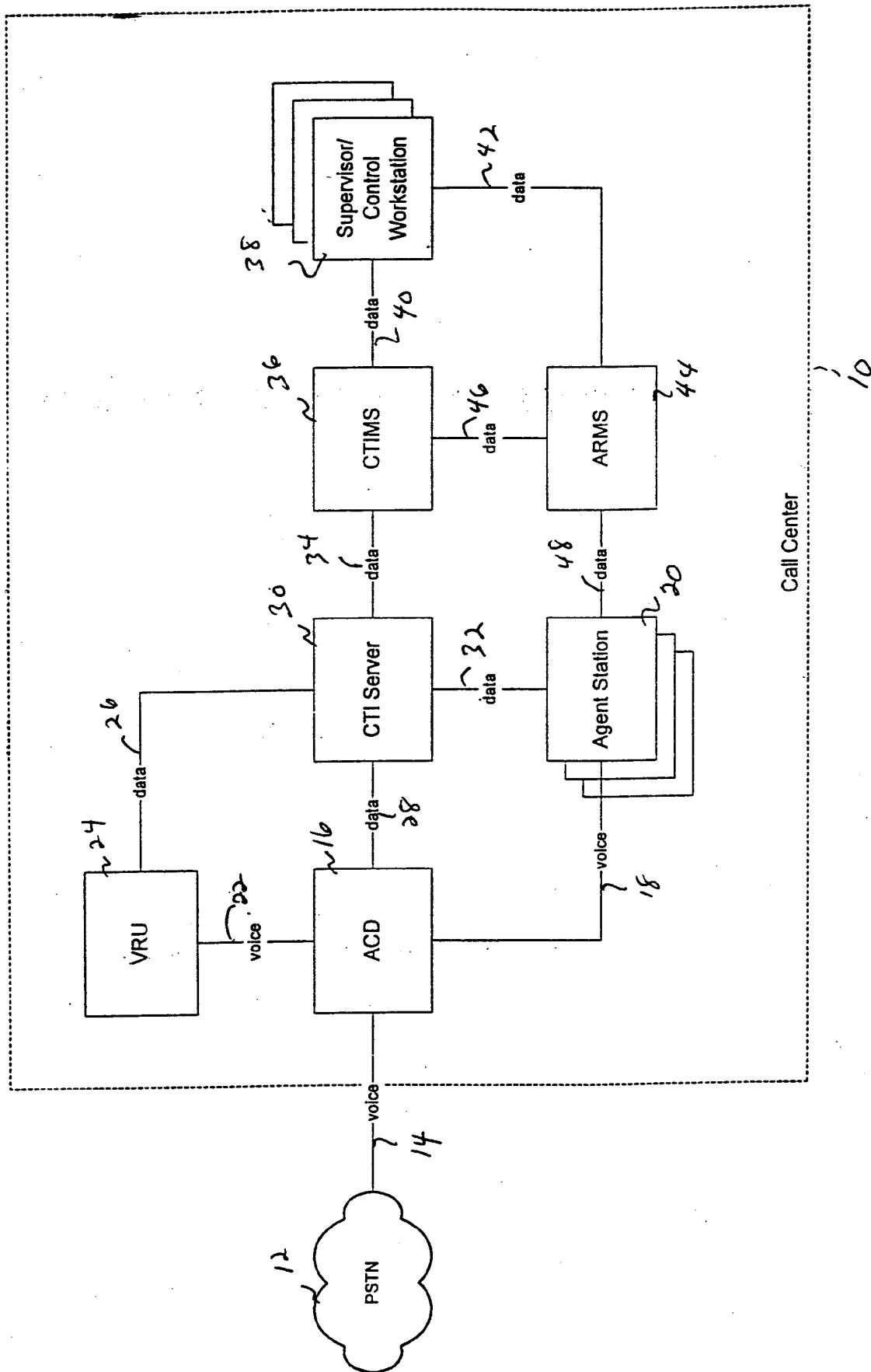


Figure 1



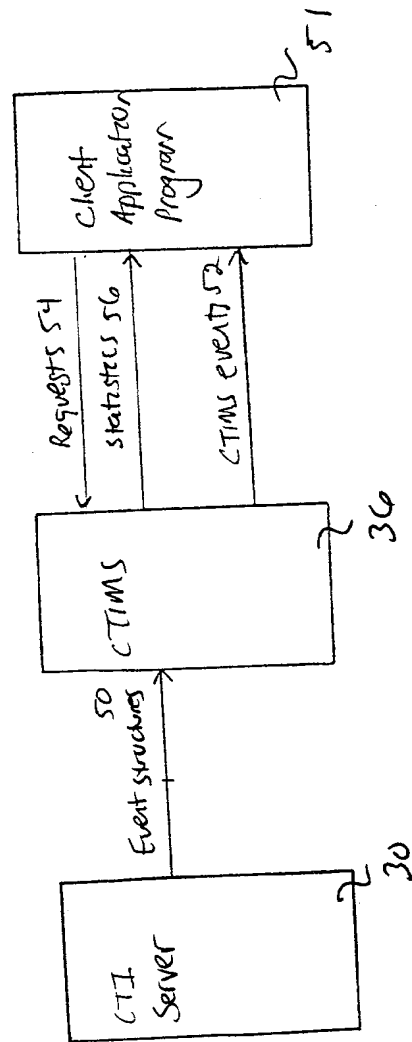


Figure 4

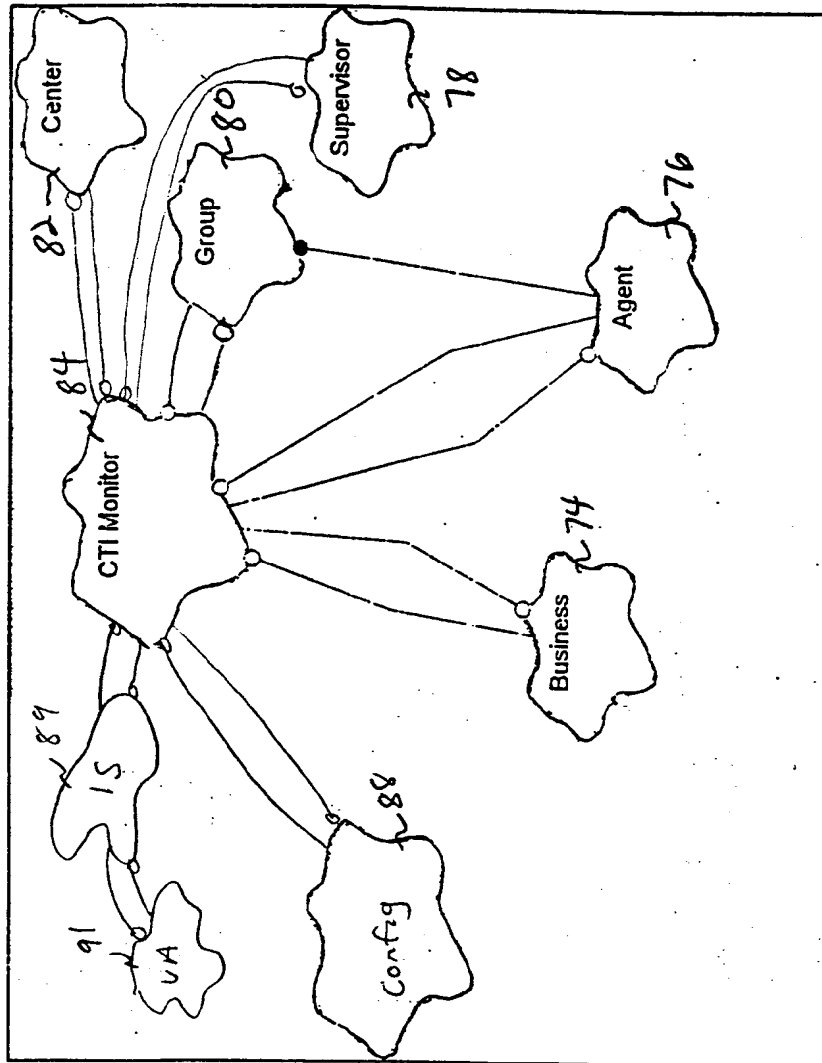


Figure 3

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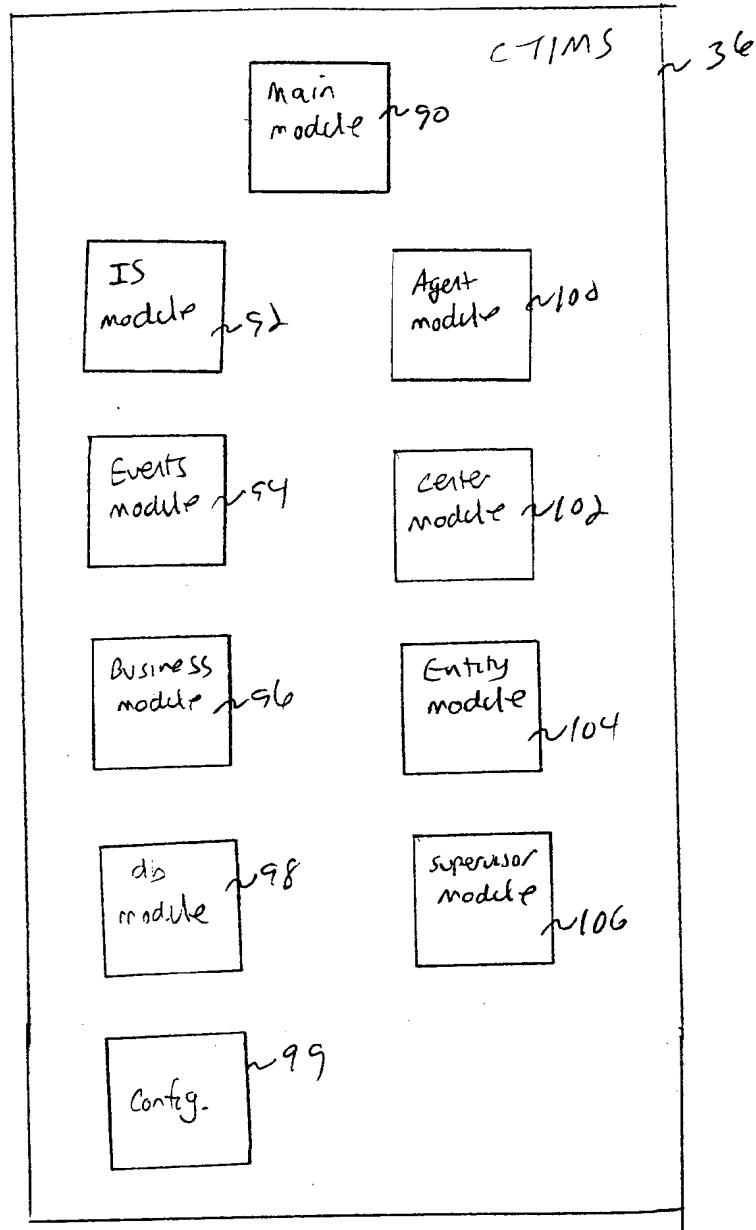


Figure 4

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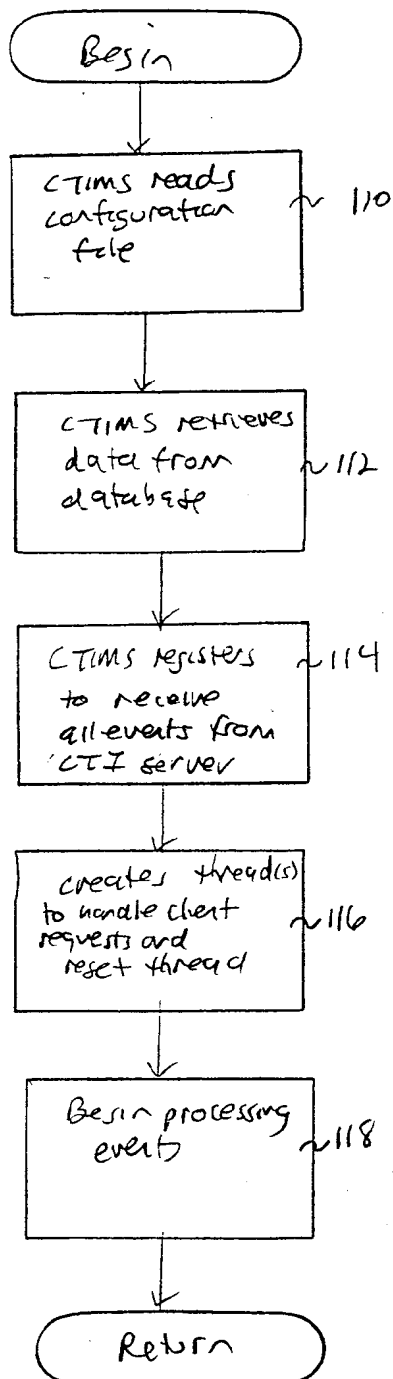


Figure 5

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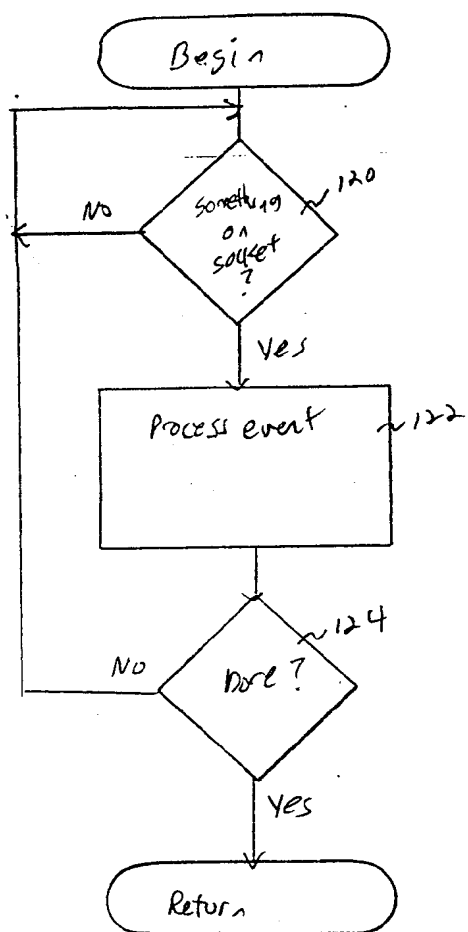


Figure 6

## Event Types for CTI-server 126

|       |                            |       |                             |
|-------|----------------------------|-------|-----------------------------|
| 128 S | Event Agent Login          | 158 ~ | Event Attached Data Charged |
| 120 S | Event Agent Logout         | 160 S | Event Error                 |
| 122 S | Event Agent Ready          | 162 S | Event Established           |
| 124 S | Event Agent Not Ready      | 164 S | Event Off Hook              |
| 136 S | Event Agent Busy           | 166 S | Event On Hook               |
| 128 S | Event Agent Not Busy       | 168 S | Event Released              |
| 140 S | Event Call Abandoned Queue | 170 S | Event Retrieved             |
| 142 S | Event Call Entered Queue   | 172 S | Event Ringing               |
| 144 S | Event Call Forward Cancel  | 174 S | Event Address Allocated     |
| 146 S | Event Call Forward Set     | 176 S | Event Rate Request          |
| 148 S | Event User Event           | 178 S | Event Server Disconnected   |
| 150 S | Event Conferenced          | 180 S | Event Transferred           |
| 152 S | Event Origins Collected    | 181 ~ | Event Mail Box Login        |
| 154 S | Event Dialing              | 183 ~ | Event Mail Box Logout       |
| 156 S | Event Address Freed        | 185 ~ | Event Voice File Opened     |
|       |                            | 187 ~ | Event Voice File Closed     |

Figure 7

Attributes of Agent object 182

|      |                      |     |                        |
|------|----------------------|-----|------------------------|
| 1905 | agentId              | 230 | availableTime          |
| 1925 | supId                | 232 | unavailableTime        |
| 2005 | AgentState           | 234 | oncallTime             |
| 2025 | monsterState         | 236 | callworkTime           |
| 2045 | InboundCalls[]       | 238 | errorTime              |
| 2065 | callCount            | 240 | unknownTime            |
| 2085 | totalCalls[]         | 242 | CorreatTime            |
| 2105 | callType             | 244 | refTime                |
| 2125 | busCode              | 246 | resetTime              |
| 2145 | onCall               | 248 | stateChangeTimeStr     |
| 2165 | pad                  | 250 | totalLoginSecs         |
| 2185 | loginTime            | 252 | totalAvailableSecs     |
| 2205 | logoutTime           | 254 | totalUnavailableSecs   |
| 2225 | stateChangeTime      | 256 | totalOncallSecs        |
| 2245 | eventEstablishedTime | 258 | totalInboundCallSecs[] |
| 2265 | eventReleasedTime    | 260 | totalOutboundCallSecs  |
| 2285 | eventReadyTime       | 262 | totalInternalCallSecs  |

Figure 8A

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Attributes of Agent object

|     |                         |
|-----|-------------------------|
| 264 | total Consult Call Secs |
| 266 | total Unknown Call Secs |
| 268 | total CallworkSecs      |
| 270 | total ErrorSecs         |
| 272 | total UnknownSecs       |
| 274 | talkTime                |
| 276 | total TalkTime [ ]      |
| 278 | avgTalkTime [ ]         |
| 280 | avgAllTalkTime          |
| 282 | avgWorkTime             |
| 284 | avgHandlingTime         |
| 286 | ghostCalls              |
| 288 | hangups                 |
| 290 | callsHandled            |
| 292 | inboundCallsHandled [ ] |
| 294 | outboundCallsHandled    |
| 296 | internalCallsHandled    |
| 298 | consultCallsHandled     |
| 300 | unknownCallsHandled     |
| 302 | skills                  |
| 304 | newAgent                |

Figure 8B



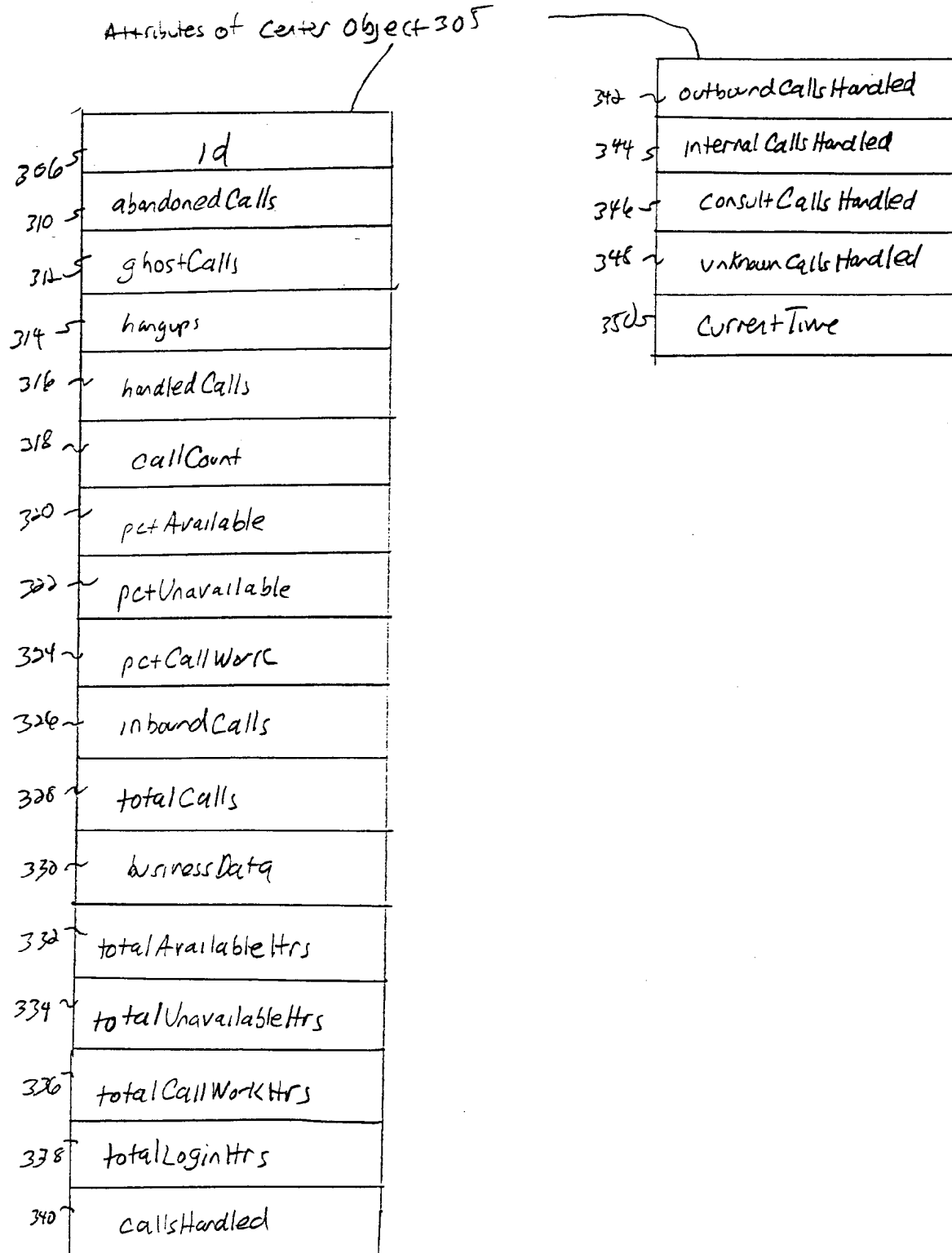


Figure 9

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Attributes of Business object 359

|       |                |
|-------|----------------|
| 360 ~ | Id             |
| 362 S | agentsOnCall   |
| 364 S | callsInQueue   |
| 366 S | abandonedCalls |
| 368 S | ghostCalls     |
| 370 S | hangups        |
| 372 ~ | handledCalls   |

Figure 10

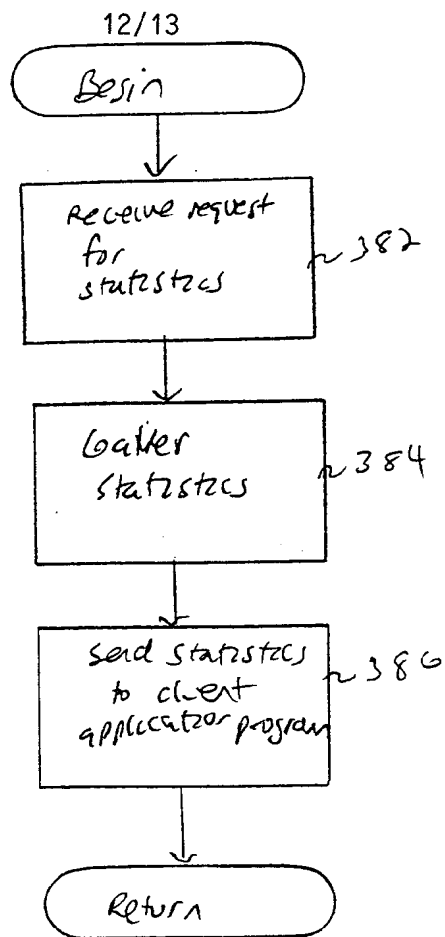


Figure 11B

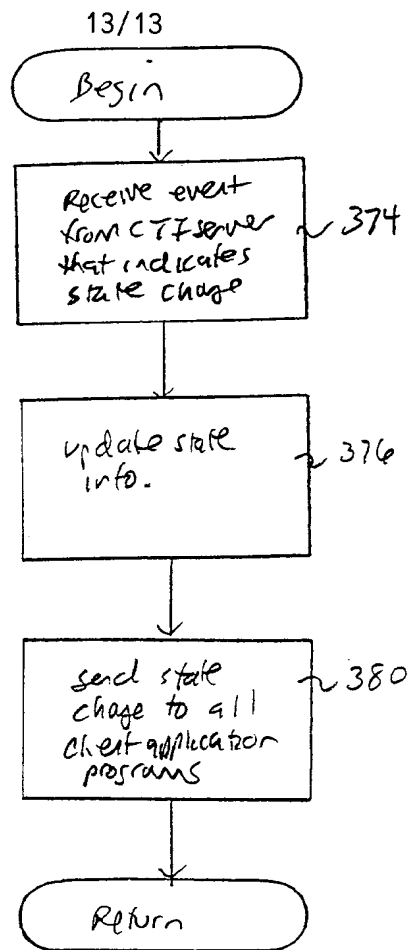


Figure 11A

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/19770

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04M3/50

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages         | Relevant to claim No. |
|------------|--|-----------------------|
| X          | EP 0 535 270 A (DIGITAL SYSTEMS INT)<br>7 April 1993<br>see figure 11                      | 1,12,20               |
| X          | see figure 8   | 10,16                 |
| X          | see page 4, line 8-18; claim 1; figure 1   | 17,22                 |
| X          | see figure 9   | 2,4-6,<br>13,18       |
| X          | see figure 10  | 3,9,14,<br>19         |
| Y          | see figures 1,11   | 7,8                   |
| Y          | -----<br>"CentreVu Solutions"<br>June 1997, LUCENT TECHNOLOGIES INC.,<br>U.S.A XP002090965 | 7,8                   |
| X          | see the whole document<br>-----  | 17,18,<br>20,21       |



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

25 January 1999

Date of mailing of the international search report

26/02/1999

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### Information on patent family members

PCT/US 98/19770

Form PCT/ISA/210 (patent family annex) (July 1992)